

Exhibit A

ADA 199

TITLE:
HIGH CALORIE ELEMENTAL DIET IMPROVES OUTCOMES AND QUALITY OF LIFE FOR TUBE FED ADOLESCENTS

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LEARNING OUTCOME:
To identify a key factor in formula selection for adolescents.

ABSTRACT TEXT:

Adolescence presents unique nutritional challenges due to the physical and psychosocial changes which define it. These challenges can be magnified by the need for nutrition support. The use of a 1.5 calorie per cc product in two adolescent home enteral patients requiring an elemental diet resulted in improvements in both physical and psychosocial parameters.

Case 1: A 14 year old female with an 8 year history of Crohn's disease was managed at home for two years with 500 cc of a 1.0 cal/cc elemental diet nocturnally. A disease exacerbation resulted in loss of 15% body weight (12 lbs) and the need for continuous feedings, which precluded her return to school. Transitioning to a 1.5 cal/cc formula reduced feeding time by >50% (to 11 hours) and allowed her to return to school. Over 6 months time she experienced a 32% weight gain (22 lbs).

Case 2: A 13 year old female with cystic fibrosis and failure to thrive (weight for age <5th %ile) was started on 500 cc of a 1.0 cal/cc elemental diet in preparation for double lung transplant. As her volume needs increased monthly due to inadequate weight gain, it became more difficult to schedule feeding time due to after-school activities and the frequent absence of an adult at home. Switching to the 1.5 cal/cc formula enabled her to increase her rate of weight gain by 70%, from an average 4.5 g/day over 5 months to 7.7 g/day over 2 months. She thus achieved the 25th %ile goal weight needed for surgery, while maintaining her level of social activity.

The 1.5 cal/cc elemental diet supported the extraordinary demands of illness and adolescent growth while affording both patients greater independence and normalcy. The familiar benefits of a calorically dense enteral formula have been successfully demonstrated in adolescents requiring an elemental diet.

Exhibit B

N16

HIGH CALORIE, PEPTIDE-BASED, LIQUID, ELEMENTAL, ENTERAL FORMULA IS WELL-TOLERATED BY PATIENT WITH QUADRUPLE ORGAN TRANSPLANT

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Baylor University Medical Center Grapevine, TX, Grapevine, TX

In Jan 1991, RK was 21 years old and 28 weeks pregnant when she suffered a malrotation of the small intestine. Within 12 hours of the infarction, she underwent emergency surgery to remove her gangrenous intestinal tract, leaving only her stomach, duodenum, and descending colon. She left the hospital on nocturnal TPN; her weight was 117 lbs. (IBW/UBW = 130 lbs.). For the next three years, RK remained on TPN; her weight increased to 130 lbs. In 1995 her liver enzymes and bilirubin began to rise, but she remained asymptomatic. In late 1999, she became extremely jaundiced and was soon in liver failure. RK was evaluated for a liver and small bowel transplant and while awaiting a donor, she developed severe HTN, internal bleeding/coagulation disorder, renal failure, pneumocystis pneumonia, and other complications. After months of hospitalization, she received a quadruple organ transplant: Small bowel, liver, kidney, and pancreas. Her remaining stomach and duodenum were removed and the donor small intestine was attached proximally to her esophagus and distally to her descending colon. RK was immediately started on an NG feeding with a powdered amino-acid-based elemental formula, which was poorly tolerated. The formula was changed to a high-calorie, peptide-based, liquid, low-osmolality elemental formula, which was immediately tolerated. RK went home on this peptide-based elemental formula providing 1875 kcal and 75 g protein/day. She also ate low-residue foods as tolerated. Within a year, RK's weight returned to 130 lbs and she decided to discontinue the NG feedings and rely only on oral intake. RK's weight fell to 103 lbs., diarrhea was continuous, and it was necessary to reinitiate TPN. Her oral intake continues as tolerated, but diarrhea and malabsorption persist. NG feedings are not an option due to nasal ulcers and scarring; NJ feedings are contraindicated. RK is considering returning to an oral version of the high-calorie, peptide-based, liquid, low-osmolality elemental formula, as it was the only enteral nutrition that was absorbed and tolerated by her fragile GI tract.



Peptamen 1.5

Exhibit C

Home Enteral Nutrition in Chronic Pancreatitis: A Case Report

Julie Meyer, RD, CNSD



Abstract

A growing body of research supports the use of jejunal enteral feedings for patients with chronic or mild pancreatitis. This case study demonstrates that administration of a high-calorie, peptide-based diet can improve clinical outcomes and results in significant cost savings for a home-care patient with chronic pancreatitis when compared with parenteral nutrition (1).

Introduction

Chronic pancreatitis is characterized by irreversible damage to the pancreas, as evidenced by tissue calcification. The most common symptoms include recurrent abdominal pain, weight loss, and steatorrhea, which can often lead to progressive malnutrition (2-5). Excessive and prolonged alcohol consumption accounts for 60% to 75% of cases of chronic pancreatitis, and in many cases, the disease continues to progress even after abstinence (2-5). Cigarette smoking has also been suggested as a contributing factor (3). Other etiologies include congenital predisposition, neoplasia, trauma, and metabolic diseases such as hyperlipidemia, cystic fibrosis, or hyperparathyroidism (2,3,6). The gallstones and dyskinesia that can cause acute pancreatitis are not associated with the chronic form of the disease (2,3). Nutrition support is frequently required during severe exacerbations of chronic pancreatitis.

Parenteral nutrition has been the traditional mode of nutrition support for patients with pancreatitis. Recent literature, however, suggests that enteral nutrition can be safe and cost-effective. Enteral feeding is the preferred route of nutrition support, depending on the severity of disease and patient tolerance (2,4,7), because there is less risk of the metabolic abnormalities, intestinal atrophy, sepsis, and infection that have

been associated with total parenteral nutrition (TPN). No significant increase in pancreatic excretion has been documented with jejunal infusion of nutrients. Therefore, jejunal administration of nutrients should not aggravate pancreatic inflammation, allowing the pancreas to "rest" (2,4,6-12). Elemental formulas stimulate the pancreas and gastrointestinal tract less than standard intact protein formulas (2,8,9,11,12), and better absorption has been reported when using small peptide, semi-elemental formulas compared with free amino acid elemental formulas (2). The enteral formula that was initially used in this case study has been studied by Freedman (10,11) for use in patients with chronic pancreatitis and found to have a minimal effect on cholecystokinin (CCK) release. CCK, a hormone that is secreted into the blood via the small intestine, causes activation of pancreatic enzyme secretion during digestion of protein and fats. Minimal CCK release is important to allow the pancreas to "rest" (2,10,11).

The following case report illustrates the clinical, quality-of-life, and cost advantages of enteral nutrition compared with TPN in a home-care patient who had chronic pancreatitis.

Case Presentation

L.B., a 62-year-old white male, was hospitalized with severe abdominal pain and cachexia due to chronic calcific, alcohol-related pancreatitis. A Hickman catheter was placed and TPN initiated during hospitalization to rest the pancreas, provide pain relief, and treat his malnutrition. He was discharged to home after 2 days in the hospital on TPN of 150 mL/hr over 12 hours (1,790 mL of TPN plus lipids) and a clear liquid diet. Shortly after discharge, he was admitted to the home nutrition support service.

His past medical history included: alcoholic pancreatitis (cessation of

drinking 20 years ago), alcoholic liver disease, gallbladder disease, chronic obstructive pulmonary disease with asbestos-related exposure, smoking (1 pack of cigarettes per day), irritable bowel disease, diverticulosis, and chronic constipation. An earlier 14-month course of therapy included two endoscopic retrograde cholangiopancreatographies, biliary tree stent placement, forced dilatation of the extrinsic compression on the common bile duct, and two pancreatic sphincteromies on separate occasions. Because he continued to complain of abdominal pain, a cholecystectomy and choledochoduodenostomy were performed. Finally, lithotripsy of the pancreas and flush-out of the major pancreatic ductal system via a nasal pancreatic tube with stone debridement were undertaken. However, none of these procedures provided long-term pain relief, and the patient subsequently received two separate celiac blocks. The goal of a celiac block is to block the pain response of afferent fibers that pass through the celiac plexus, which includes the pancreas and abdomen. A Whipple procedure (pancreatoduodenectomy) was not an option because of the inability to free the pancreas from major vessels in the area.

L.B. initially presented to the nutrition support service with malnutrition due to inadequate intake of food because of pain associated with eating and increased calorie needs due to catabolism. His anthropometric data and the details of nutrition therapy over the course of treatment are summarized in Table 1. He presented at 79% of usual body weight. Blood chemistries were monitored weekly while he received home parenteral nutrition (HPN), then bimonthly or monthly while receiving home tube feedings. Most of the laboratory results (Table 2) remained relatively stable during the course of HPN, with

(Continued on next page)

Support Line December 2000 Volume 22 No. 6

the exception of liver function tests, including serum glutamic-oxaloacetic transaminase (SGOT), serum glutamic-pyruvic transaminase (SGPT), and alkaline phosphatase. These values rose significantly during the fourth week of HPN therapy, began to plateau at week 7, and returned to normal once HPN was discontinued. These values were monitored to avoid the hepatic complications that may occur with long-term HPN. When the tube feeding started at week 14 of nutrition therapy, the SGOT and SGPT were in the normal range, but the alkaline phosphatase remained elevated at 308 U/L. It decreased to 130 U/L within 3 weeks of discontinuing the HPN. The decrease in hemoglobin, hematocrit, and iron concentrations over time most likely were due to chronic disease and low iron intake during HPN.

The initial HPN formula provided 30 kcal/kg (1.2 times the Harris-Benedict equation) and 1.8 g/kg protein. (Indirect calorimetry was not available.) Additionally, L.B. continued to drink clear liquids. Nevertheless, he experienced severe abdominal pain when drinking clear liquids, so the diet was discontinued during the third

week of HPN. Despite HPN, his weight decreased to 46.4 kg (78% of usual body weight) by the fourth week of therapy. Calories were increased to 37 kcal/kg, and protein was maintained at 1.8 g/kg because albumin levels were normal. During the seventh week of HPN, L.B.'s weight had dropped to 45 kg (76% of usual body weight); energy support was increased to 42 kcal/kg and protein to 2.0 g/kg. Protein was increased to increase calories without additional carbohydrate because the patient was approaching the maximum oxidation rate of carbohydrate at 7 g/kg/day. Because L.B. no longer was reporting pain, another trial of a clear liquid diet was initiated at the seventh week of HPN. However, he again experienced abdominal pain and was made NPO.

Using pancreatic enzymes to decrease exocrine secretion from the pancreas can often relieve the abdominal pain associated with chronic pancreatitis when oral intake is initiated. It is believed that high doses of exogenous pancreatic enzymes "rest" the pancreas by minimizing CCK release (3). Patient compliance with enzyme therapy is essential for optimal pain control. L.B. admitted later that he

was often noncompliant with the prescribed enzyme therapy when he was eating because taking the prescribed amount of enzymes made him feel "bloated and full." He often complained of flatulence, abdominal cramping, and an orange greasy substance in his bowel movements. The most severe episodes of pain were associated with cramping before a bowel movement and pain with eating while on HPN. This condition was further complicated by his history of irritable bowel syndrome and chronic constipation.

Calories were increased again during the 11th week of HPN to 44 kcal/kg (120% of Harris-Benedict equation \times 1.5) to promote weight gain because he continued to remain below goal weight. Hypermetabolism, with energy needs as high as 139% of basal energy expenditure, is most common with acute pancreatitis (61% of patients), but can also occur with chronic pancreatitis (33% of patients) (14,15). The greatest energy needs occur when pancreatitis is complicated by sepsis (14,15). Hebuterne and colleagues (14) found that more than 60% of nonseptic, undernourished patients who had alcohol-related chronic pancreatitis

Table 1. Selected Nutrition Support Data for L.B.

Week	1	4	7	11	14	18	50
Height	67 in (167.5 cm)						
Weight	46.8 kg	46.4 kg	45 kg	46 kg	46.8 kg	47.3 kg	51.4 kg
% Ideal Body Weight	77%	77%	74%	76%	77%	78%	85%
% Usual Body Weight	79%	78%	76%	76%	79%	80%	87%
Protein Provided by Nutrition Support (g/kg)	1.8	1.8	2.0	2.0	2.0	1.9	1.8
Energy Provided by Nutrition Support (kcal/kg)	30	37	42	44	43	47	44
Nutrition Support Diet	• TPN • CL	• TPN	• TPN • CL	• TPN • CL	• TF initiated • TPN continued • CL	• TF Low-fat diet • TPN discontinued	• Regular diet • TF discontinued

TPN= total parenteral nutrition, CL= clear liquids, TF= tube feeding

were hypermetabolic. Nicotine has also been shown to increase metabolic rate (14).

During week 11, clear liquids were attempted again, with L.B. tolerating small amounts of juice, broth, sports drink, and gelatin, but experiencing episodes of both diarrhea and constipation with oral intake. Due to his continued weight loss, increased values on liver function tests, and maximal provision of calories and carbohydrate (7g/kg/d carbohydrate) in his HPN, the nutrition support service recommended a trial of jejunal tube feedings using a peptide-based formula. (The nutrition support service included a clinical medical advisor-physician, registered pharmacist, home infusion nurse, and certified nutrition support dietitian.) The change in feeding modality was discussed with L.B., who agreed. During the 14th week of HPN, a nasojejunum (NJ) tube was placed and a peptide-based formula (1.0 kcal/mL) initiated at 20 mL/hr for 10 hours during the day and gradually increased to a goal rate of 150 mL/hr with HPN infusion at night. No pancreatic enzymes were administered with tube feeding (unless he also was eating orally) because tube feeding in the jejunum would prompt minimal pancreatic secretion. HPN was tapered

as the tube feeding increased to keep the nutrient intake consistent (approximately 2,000 kcal with 90 g protein per day). Because L.B. continued to work while receiving nutrition therapy, a portable pump was used for daytime tube feeding infusion. During the 16th week of nutrition therapy, L.B. was gradually transitioned to a nutritionally equivalent 1.5 kcal/mL peptide-based formula infused at 150 mL/hr for 10 hours at night (2,250 kcal) to reduce the number of hours of tube feeding, and the HPN was discontinued. During the 17th week of therapy, L.B. was hospitalized with a Hickman catheter infection that necessitated catheter removal. His NJ tube had also migrated out of the jejunum and was repositioned with radiographic verification of placement.

During the transition to enteral feedings, L.B. experienced frequent abdominal discomfort (bloating, flatulence, and reflux), occasional heartburn, and abdominal cramping. He was advised to decrease the rate of tube feeding from 150 mL/hr to 125 mL/hr, but was reluctant to do this because he wanted to avoid additional hours of infusion. Some of these symptoms were attributed to the NJ tube migrating into the stomach. He continued to have weekly bouts of increased

abdominal discomfort, gas, and an orange greasy substance in his bowel movements, which was attributed to fat malabsorption associated with pancreatitis. L.B.'s occasional non-compliance with taking the prescribed amount of pancreatic enzymes during oral intake probably also contributed to the steatorrhea. The tube feeding formula had a high percentage of medium-chain triglyceride oil as its fat source to promote better absorption. Following the development of a sinus infection from the NJ tube, a percutaneous endoscopic jejunostomy feeding tube was placed during the 18th week of nutrition therapy.

L.B.'s diet was slowly advanced, and by the 30th week of nutrition therapy, he was tolerating small bland meals. Pancreatic enzymes were prescribed with all meals and snacks. He had not taken pancreatic enzymes during the tube feeding. His weight remained stable at 47.7 to 49.5 kg for 6 months while receiving the tube feeding at the goal feeding rate.

During week 48, L.B. developed a left spontaneous pneumothorax, causing significant respiratory failure, and was hospitalized for drainage of the pneumothorax. He quit smoking at this time and reported reduced shortness

(Continued on next page)

Table 2. Selected Laboratory Values for L.B.

Week	13	14	15	16
Weight (kg)	47.7	48.5	49.5	49.5
Albumin (g/dL)	3.2	3.0	3.0	3.0
Bilirubin (mg/dL)	0.4	0.4	0.4	0.4
ALT (U/L)	10	10	10	10
AST (U/L)	10	10	10	10
Alkaline phosphatase (U/L)	100	100	100	100
Cr (mg/dL)	1.0	1.0	1.0	1.0
BUN (mg/dL)	10	10	10	10
Glucose (mg/dL)	100	100	100	100
Hemoglobin (g/dL)	10.7	10.9	10.8	10.8
Hematocrit (%)	32.5	33.8	36.1	36.1

Support Line December 2000 Volume 22 No. 6

of breath and cough and improved appetite. On week 50 of nutrition therapy (approximately 7 months after start of the tube feeding), L.B.'s weight was up to 51.4 kg, he was tolerating a low-fat diet, and the tube feeding was discontinued. His weight continued to increase over the next year, he returned to his usual body weight of 57.6 to 58.5 kg, and he has not experienced any recurrence of pancreatitis for 2 years.

Conclusion

The benefits of enteral nutrition compared with parenteral nutrition in this patient with chronic pancreatitis were evidenced by improved clinical outcomes, including normalization of liver function tests, energy level, and weight gain. Significant cost savings from enteral therapy were calculated as \$625 per week, \$2,500 per month, and \$30,000 per year. L.B. did not always comply with his low-fat, high-fiber diet or with his pancreatic enzyme therapy. However, we were fortunate to work with a patient who was willing to have an NJ tube initially for enteral feeding and continue the administration of jejunal feeding for the necessary length of time.

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Julie's mentor was Janet Furman Simmons, MS, RD, who is a nutrition support clinician at Rush-Presbyterian-St. Luke's Medical Center, Chicago, Ill.

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November 1, 2000

Dear Nutrition Support Dietitian:

Many of you entrust your home nutrition support patient's needs to Coram Healthcare. We appreciate your trust and share your interest in dependable, high-quality service.

For 20 years, Coram's history has been built upon quality care, clinical excellence, and customer service. We have contributed to the health and healing of millions across the country, earning a reputation for superior care, and we are proud of it.

We value the expertise of nutrition support dietitians at Coram Healthcare. Nutrition support dietitians are integrated within our organization—in clinical patient care, operations, and sales. Some of you may have heard or read that Coram Healthcare Corporation filed voluntary petitions for relief and a plan of reorganization under Chapter 11 of the U.S. Bankruptcy Code on August 8, 2000. We want you to know why we did this and be assured that this will not affect your patients in any way.

Coram Healthcare was created from the merger of several home infusion companies and has been dealing with high levels of debt for years. The filing simply provides a legal framework for the parent companies to restructure debt, which the lenders have agreed to forgive. This will allow Coram Healthcare to be financially strong and even better positioned to continue as the quality leader in comprehensive home nutrition services.

It is important to note that this has not and will not disrupt supplies, services, or the quality of care provided by the professional staff at our branches. Please understand our Coram branches can and will continue to meet all financial and service obligations to patients, customers, employees and suppliers.

Our commitment to our consumers and you the clinicians, who work with these patients, continues. If you have any questions, please do not hesitate to call me at 1-800-CORAM HC. We value our relationship with you and look forward to providing friendly, caring, and quality service for years to come.

Sincerely,

Carol Ireton-Jones, PhD, RD, LD, CNSD
Director of Nutrition Services

Exhibit D



ASPN

American Society for Parenteral
and Enteral Nutrition®

24TH CLINICAL CONGRESS

PROGRAM
BOOK

January

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NUTRITION PRACTICE POSTERS

P0085

Icton-Jones Equation vs Indirect Calorimetry in the Estimation of Rest Energy Expenditure of Surgical Patients. Amado De Jesus Arzú, Hospital General Dr. Manuel González, Toluca, Mexico, DF

To compare Icton-Jones equation with indirect calorimetry in the estimation of rest energy expenditure (REE) in surgical patients. Prospective and comparative clinical study. For statistical validation we used ANOVA test and linear correlation coefficient, $p < 0.05$. We estimated Rest Energy Expenditure (REE) by the Icton-Jones equation with parameters for normal breathing patients and by indirect calorimetry in hospitalized patients, from November 1998 thru March 1999. We studied age, weight, height, body mass index (BMI), overweight percentage, respiratory coefficient (RC) and minute volume respiratory coefficient (MRC). We divided our patients in 5 groups: group I severe acute pancreatitis, group II enterocutaneous fistulae, group III cancer, group IV sepsis and group V major surgery. Indirect calorimetry was our "Gold Standard". We performed a total of 166 estimations by indirect calorimetry and by the Icton-Jones equation. The age of our patients was 39.87 ± 14.41 years ($M \pm SD$). We performed 40% of our calculations in group I, 31% in group II, 7% in group III, 14% in group IV and 7% in group V. The REE was in 1505 ± 290 Kcal/day estimated by calorimetry. The RC was 0.89 ± 0.14 and MRC 0.54 ± 0.16 . Icton-Jones equation gave us a REE of 1526 ± 247 Kcal/day. These results were for all groups. We got a linear correlation coefficient of 0.5 ($p = 0.0000$) for all groups. The correlation for group I was 0.5 ($p = 0.0000$), for group II 0.5 ($p = 0.0049$), for group III 0.9 ($p = 0.0000$), for group IV 0.7 ($p = 0.0043$) and for group V 0.7 ($p = 0.0004$). The percentage of variation of the equation was $2.46-22.1\%$ for all groups. There is good correlation between Icton-Jones equation and indirect calorimetry for estimating REE in general population. But with different groups of patients the equation correlates poorly with indirect calorimetry. The error of the equation ranks between 2 to 22%. Indirect Calorimetry continues to be the "Gold Standard" for estimating REE.

P0087

Use of Condensed Semi-elemental Diet in the Treatment of Pediatric Crohn's Disease. L. Bouchiller, A. Deslongchamps, E. Salmans, St. Justine Hospital, Montreal, Quebec

Nutritional therapy is an effective therapeutic option for pediatric Crohn's disease (CD). In addition to the generally accepted aim, the large volume of liquid defined formula diets (HCA) that must be consumed during a one-month treatment period (2200-3000 ml per day) can hinder compliance. A retrospective study was performed to evaluate the effect of the use of condensed semi-elemental diet (1.5 kcal/ml) (CSED) on the acceptability, rate of administration, tolerance, weight gain, and efficacy of nutritional therapy for pediatric CD patients. The medical records of all our CD patients, treated with CSED since October 1998 for either induction of remission (new onset or relapse) or growth failure and relapse prevention ($n = 10$), were reviewed. Effective treatment was defined as a patient who successfully completed > 4 weeks of strict CSED (50-80 kcal/kg ideal weight/day) and whose disease activity was controlled (Harvey-Bradshaw Index < 4). The use of CSED was found to be as effective and as well tolerated as other nutritional therapies in pediatric CD. Patients who had previously been treated with standard 1.0 kcal/ml semi-elemental formula (SF) produced the reduced volume of condensed product required to meet their nutritional needs. More patients on the CSED showed no feeding intolerance or feeding problems compared with patients in our previous study using SF (60% IF or both for CSED, vs 41% for SF). Average weight gain (% wt change/4 wk treatment) was

not significantly different in IF vs CSED groups ($p = 0.14$ vs 0.15). There was also no difference in weight gain in regard to route of administration. Overall, our data suggest that the use of CSED improved adherence to therapy and ultimately clinical outcomes.

Table 1.

Condition	n	Treatment Success	Tube Feeding (n)	SBH (n)	PR	S.Wt Gain
Relapse	7	4/7	5/10	2/10	2/10	7.17 ± 4.1
Relapse	31	27/31	27	17	20	3.44 ± 4.1
Growth	7	2/7	2/7	1/7	2/7	3.44 ± 4.1
Relapse and Prevention	38	32/38	32/38	32/38	32/38	3.44 ± 4.1
Total	25	19/25	19/25	12/25	12/25	4.02

P0088

Monitoring of Micronutrient Status for a Patient with Short Bowel Syndrome Receiving Home Parenteral Nutrition. L. B. Bouchiller, C. Chamberlain, M. Deslongchamps, St. Justine Hospital, Montreal, Quebec

Patients with short bowel syndrome (SBS) may require prolonged use of home parenteral nutrition (HPN) and with careful clinical management HPN needs may be reduced. Regular nutritional assessments help to identify nutrient deficiencies in these patients. A thirty-five year old male with SBS receiving HPN for nine years manifested clinical signs and symptoms of vitamin deficiencies which included dry flaking skin, dull, dry and brittle hair, and splinter hemorrhages on the nails identified on routine blood follow-up. Initial laboratory studies indicated vitamin C deficiency. Further investigations revealed iron, vitamin A and mineral deficiencies including vitamins A, D, E, K, magnesium and copper. Serum magnesium level was elevated. At this time, liver function tests were elevated and patient desired to decrease infusion time. The HPN was revised one day each week. In order to meet nutrient needs, multiple liquid vitamins and mineral preparations were provided. No hypophosphatemia was observed. After 15 weeks with careful nutrient supplementation the patient perceived improvement in physical signs and symptoms and demonstrated progress in laboratory values. The patient continues to have only one day each week making weight management and caloric requirement a challenge. Even though iron status remains elevated, further research on the management of iron and other vitamin therapy will continue in order to achieve normal levels.

P0089

Outcome of Chronic Cholestasis in Adult Patients Receiving Home Parenteral Nutrition. C. Chamberlain, M. Deslongchamps, Gerard S. Bouchiller, D. Robert, Centre de Nutrition Parentérale, St. Justine Hospital, Montreal, Quebec

Chronic cholestasis (defined as 2 out of 3 abnormalities of liver function tests: total bilirubin, alkaline phosphatase or γ -GT > 1.5 times the upper limit of normal) is a major complication of long-term parenteral nutrition (PN). The fifth year) but little information is known about its evolution.

Exhibit E

ORIGINAL COMMUNICATION

Gastric emptying of two whey-based formulas of different energy density and its clinical implication in children with volume intolerance

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Objective: Whey-based formulas have faster gastric emptying than casein-based formulas. Isocaloric, isovolumic, whey-based formulas of different osmolality and fat content empty in a similar manner. Will the gastric emptying of high and low energy density whey-based formulas be similar?

Design: We studied the gastric emptying rate of equal volumes of two whey-based formulas of different energy density (4.18 kJ/ml and 6.27 kJ/ml) and osmolality (270 and 450 mOsm/kg, respectively) in 10 children (4.5–12y) with volume intolerance and resultant inability to gain weight.

Results: The two formulas had comparable gastric emptying rates at 30, 60, 90 and 120 min. Over a one month clinical trial, substitution of the lower energy density whey-based formula (no weight gain over 2 months) with an equal volume of the high energy density formula produced a mean weight gain of 1.17 ± 0.5 kg per patient without change in tolerance.

Conclusion: The higher density whey-based formula can safely substitute an equal volume of a lower energy density formula to produce weight gain without affecting tolerance.

Implication: This provides an important intervention for increasing energy intake in children with volume intolerance or fluid restriction.

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Keywords: gastric emptying; whey; feeding intolerance

Introduction

Gastric emptying of liquids is influenced by several factors, particularly type and content of fat, volume and osmolality. The most important factor, which governs gastric emptying, is the energy content of the meal and it overrides the energy composition of the meal (Hunt *et al.*, 1985; Hunt & Stubbs, 1975). Earlier, we have shown that the type of protein is also an important factor that affects gastric emptying of liquid formulas (Fried *et al.*, 1992). Different types of isoelectric,

isovolumic whey-based formulas empty faster than similar casein-based formulas and are associated with fewer episodes of emesis and gastroesophageal reflux (Fried *et al.*, 1992; Khoshoo *et al.*, 1996; Billeaud *et al.*, 1990; Tolia *et al.*, 1992). This effect is seen irrespective of the osmolality, fat composition or nature of whey. The next logical step is to evaluate whether the presence of whey as the protein moiety will override the energy content of the meal in influencing gastric emptying of a liquid formula. We studied the gastric emptying rates of equal volumes of two similar whey-based formulas of different energy densities, i.e. 4.18 and 6.27 kJ/ml, in children with volume intolerance and also assessed weight gain.

Methods

This study was conducted in a prospective manner after approval from the Institutional Review Board. The study population comprised of 10 children with spastic quadri-

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Gastric emptying of two whey-based formulas
V Khoshdel and S Brown

2

plegia (4.5–12 y; six male, four female) who were fed exclusively through a gastrostomy tube using bolus feeds. All children were referred to the Pediatric Gastroenterology and Nutrition Clinic more than 6 months prior to the study for poor weight gain secondary to volume intolerance as manifested by gagging, discomfort or emesis following bolus feeds. To hasten gastric emptying and improve tolerance the formula had already been switched to a whey-based formula; however, the children were still unable to advance the volume to optimize energy intake for weight gain. For this reason all patients had failed to gain any weight during the previous 2 months. They were all managed by the same physician, on an intent-to-treat basis. After obtaining written consent and overnight fast a ^{99}Tc sulfur colloid gastric emptying scan was performed with 150 ml of either of the two formulas in random allocation as described before (Fried *et al.*, 1992). After at least 48 h, to allow time for decay of radioactivity, a similar scan was repeated with the other formula. All conditions were kept identical during both scans including timing of the scans. Each scan was performed for 120 min. The radiologist performing and interpreting the scans was unaware of the formula used. The formulas used were: Peptamen (4.18 kJ/ml, 270 mOsmol/kg) and Peptamen 1.5 (6.27 kJ/ml, 450 mOsmol/kg). These formulas were selected because despite different energy densities they have a similar energy composition and both formulas are commercially available (Nestle Clinical Nutrition Inc., Deerfield, IL, USA), hence have immediate patient care relevance. The composition of these formulas is provided in Table 1. Following the second scan the formula was switched to Peptamen 1.5 but delivered in the exact same manner as Peptamen, i.e. same volume, duration of infusion and feeding schedule. The parents were asked to maintain a diary of symptoms suggesting intolerance, i.e. gagging, discomfort, emesis and diarrhea. A 1 month trial of this higher energy formula was given during which time nude body weights were monitored on a weekly basis. Following this period the nutritional intervention was reassessed and appropriate changes were made with a view to optimizing nutritional status. Data on individual patients and groups was compared using a paired *t*-test and two-way ANOVA for repeated measures.

Table 1 Energy composition of the two whey-based formulas per 1000 ml

	Peptamen	Peptamen 1.5
Energy (kJ)	418	627
Protein (g)	40 (16)	60 (16)
Carbohydrate (g)	127 (51) ^a	191 (51) ^a
Fat (g)	39 (33)	58.5 (33)

Figures in parentheses denote percentage contribution to total energy. The fat blend in both formulas comprises medium and long chain triglycerides in the ratio of 70:30, respectively.

^aMaltodextrin 88%; corn starch 12%. Maltodextrin 91%; corn starch 9%.

European Journal of Clinical Nutrition

Results

All patients were clinically stable with normal hydration status (urine specific gravity <1.025), normal thyroid functions (thyroxine, thyroid stimulating hormone), serum albumin and electrolytes (Na, K, Cl, Mg, Ca and CO₂). Each patient served as his/her own control. The gastric emptying of the two formulas, at all phases of the 120 min study period was similar in all patients individually ($P > 0.05$). The mean \pm s.d. percentage residual gastric activity of the two formulas at 30, 60, 90 and 120 min was similar ($P > 0.05$) and is given in Table 2. Eight of these 10 patients were enrolled for the clinical trial with Peptamen 1.5. Two patients were excluded because they were considered unreliable. Patients were considered unreliable if they had a history of having missed more than two clinic appointments over the past 1 y without sufficient reason. This was important to predetermine because we felt that the semi-objective data on tolerance recorded by the parents over the course of the 1 month trial with Peptamen 1.5 needed to be recorded conscientiously and in an extremely reliable manner. The mean weight gain over the 1 month trial period with equal volume of Peptamen 1.5 (1.17 ± 0.5 kg) was significantly greater than ($P < 0.05$) the no weight gain observed over the previous 2 months while consuming Peptamen. The parents reported no change in general symptoms, symptoms of tolerance or stooling pattern during the trial with Peptamen 1.5 as compared to while the children were consuming an equal volume and identical feeding schedule with Peptamen.

Discussion

Gastric emptying of liquid formulas is affected by several factors. Increased osmolality and a higher fat content delay gastric emptying. The energy content of a meal, irrespective of its composition, has been shown to be the most important factor that affects the gastric emptying of a meal (Hunt *et al.*, 1985; Hunt & Stubbs, 1975). We have shown that the nature of protein is another factor that influences the gastric emptying of a liquid meal, irrespective of osmolality and energy composition, i.e. whey-based formulas empty the stomach faster than equal volumes of isoeNERgetic casein-based formulas (Fried *et al.*, 1992). However, equal volumes and energy content of different whey-based formulas empty the stomach in a comparable manner despite differences in their composition, i.e. a hyperosmolar, intact whey-based formula;

Table 2 Mean (s.d.) percentage residual gastric activity at different time intervals with 150 ml of the two formulas

	30 min	60 min	90 min	120 min
Peptamen	74 (11)	57 (9.4)	43 (13)	27.5 (16.3)
Peptamen 1.5	77 (11.5)	60 (12.4)	47 (16.3)	31.4 (19.9)

$P > 0.05$ for all comparisons between the two formulas at different time intervals.

a hyperosmolar, whey hydrolysate-based formula and an iso-osmolar, whey hydrolysate-based formula with fat content predominantly as medium chain triglycerides (Fried *et al.*, 1992). This clearly implies that the nature of protein, i.e. whey, overrides the osmolarity and fat content of a formula in affecting its gastric emptying. Therefore whey as well as the energy content of the meal emerge as the two most important determinants of gastric emptying. Data from the present study suggests that the presence of whey as the protein moiety in a liquid formula will override the effects of the energy content of the meal since equal volumes of two similar whey-based formulas of very different energy densities were shown to empty at similar rates despite a major difference in osmolarity and total fat, carbohydrate and protein content. These findings were corroborated during a one-month trial of Peptamen 1.5, the whey-based formula with higher energy density. In accordance with the results of the gastric emptying scans, and as expected, there was no change in tolerance after the formula was changed from Peptamen to an equal volume of Peptamen 1.5 and produced the desired outcome of a significant weight gain.

In conclusion, our present study shows that higher density whey-based formulas could be effectively delivered to produce weight gain without change in tolerance in children receiving lower density whey-based formula and who have reached their maximum tolerated volume and fail to gain further weight. We already know that whey-based formulas empty faster than casein-based formulas. It is then logical to state that a higher density whey-based formula can safely

Gastric emptying of two whey-based formulas
V Khoshoo and S Brown

3

substitute equal volume of lower energy density whey or casein-based formula. This provides the basis of an effective intervention to increase energy intake in patients with volume intolerance or fluid restriction without compromising tolerance.

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Exhibit F

PROGRAM BOOK

CLINICAL CONFERENCES

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patient receives optimal nutrition care.

79 Case Studies

Abstract
Withdrawn

78

Long Term Surgical Jejunostomy Feeding in Young Children with Gastroesophageal Reflux and Asplenia.
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Gastroesophageal reflux disease (GERD) is common in children with neurological disease and in children with congenital esophageal anomalies. GERD in young children is associated with with feeding difficulties and may also contribute to wheezing and asthma. The vicious cycle of GERD-feeding problems-asthma-GERD is difficult to break. Nissen fundoplication (NF) is effective, however significant long-term postoperative morbidity is common. In this study children with GERD and asthma fulfilling the criteria for fundoplication but medically unfit for NF had a surgical jejunostomy feeding (JF) tube placed. Aim: To evaluate long-term JF. Subjects and Methods: Six children, 6 boys, with severe GERD, feeding difficulties and chronic asthma were included in the study. 3 children, 2 boys, had profound neurological impairment, 1 post-op gastroesophageal stricture, 1 post-op diaphragmatic hernia and 1 VLBW with BPD. Jejunostomy feeding tube was placed at median age 14.5 months (3-18) and continuous pump-feeding 16-18 hours daily at home was started. The outcome of the treatment was evaluated by measuring the frequency of respiratory problems, vomiting, acute hospital admissions, antepostoperative and by questionnaire filled in by all the parents. Results: Median time for JF was 6 months (5-12), total 44 months. Vomiting and acute hospital admissions were considerably reduced in all children. 4/6 children had catch-up in growth during JF. Respiratory problems and use of inhaled medication were reduced in 3/6, unchanged in 2/6, worsened in 1. Postoperative wound complications were seen in one child and healed promptly. The jejunostomy tubes fell out more than once in all children, and were replaced by the parents at home. All parents expressed satisfaction with the outcome of the treatment for their child. Conclusion: Long-term JF is feasible in young children with GERD and asthma.

80

Case Study: Successful Use of B Vitamins to Restore Hematocrit Levels in Potentially-Fed Patient with a History of Meckel's Diverticulum.
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Recent research has shown that hyperhomocysteinemia is a significant risk factor for arterial and venous thrombosis. The mechanism for this is not completely understood. However, it is known that high levels of total homocysteine levels and that folic acid is only effective if the patient has low levels in vitamins B-12. Vitamin B-6 has been shown to enhance the conversion of folic acid to vitamin B-12 and B-6 for their patients. To our knowledge, no research has published that addresses the use of these vitamins to lower homocysteine levels in patients with a history of Meckel's Diverticulum of the small intestine without. A 65 yo female was admitted for 304798 with severe anemia, leukopenia, and thrombocytopenia after multiple admissions for lower GI bleeding. A complete work-up revealed metabolic evaluation of several organ systems including renal and liver function. Tests done to identify an autoimmune etiology were negative. A complete work-up was performed. The work-up revealed severe vitamin B-12 deficiency. Supplemental folic acid 5 mg daily and vitamin B-6 200mg/d were started and have been continued since then. The patient was discharged home on total parenteral nutrition (TPN) which included the supplemented B vitamins and coenzyme A for a waiting period to allow for her stomach, as well as her undernourished state, to recover from the chronic collapsed vessel development. She did well at home except the third episode of severe GI bleeding to start oral nutrition. A repeat complete work-up revealed increased collagen development of meckel's diverticulum. On TPN a jejunostomy was performed at which time a 20 cm segment of chronically ischemic strictured small bowel was resected and anastomosis. The postoperative report confirmed the diagnosis of chronic ischemia. The rest of the case was unremarkable. The patient was discharged home maintaining a regular diet and TPN. The results of a follow-up laboratory test on 7/2 was a low normal homocysteine level. Therefore, she was instructed to continue her supplemental vitamins to prevent a relapse of homocysteine level. She also continues to take coenzyme A. This case study illustrates the need to determine the prevalence of hyperhomocysteinemia in patients with chronic meckel's diverticulum and to maintain the effectiveness of supplemented B vitamins in managing these patients.

78